

Contact Information

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**Robert Mace**

**NAVAIR TOPSCENE Representative to CENTCOM**

# Naval Mission Rehearsal Program (TACTICAL OPERATIONAL SCENE) NAVAL AIR SYSTEMS COMMAND NAVAL AVIATION TRAINING



# **TOPSCENE is the Government's Navy / Marine Corps Mission Rehearsal Program Office managed by NAVAIR PMA205 located at NAS Patuxent River**

- Uses a Variety of imagery scene visualization tools support mission rehearsal and preview for USN/USMC air and ground**
- Coordinate management of MOAs with Army, Air Force and joint entities**
- Supports family of hardware and software applications**
  - Ranging from PC laptop and desktop to full size dome simulators**
  - Managing multiple government database production facilities**
  - Access to all government and commercial imagery sources**
  - Logistics network with government representatives on both coasts**

# ***TOPSCENE: Operational In All Services***



**All deployed CV(N)s, USS  
BATAAN  
SEALS NAB Coronado,  
selected NAS**

**Navy**



**Deployed Amphibious  
Assault Ships w/  
assigned MEU,**

**Marines**



**MCAS CONUS/OCONUS  
Spec Ops Forces, Ft  
Campbell,  
US Forces Korea,  
USAF KFOR**

**Army**



**AF Spec Ops, Hurlburt  
Fld,  
PGM Training,  
selected AB**

**Air Force**

# TOPSCENE Joint Deployments (Jul 2001)



## USN (39)

USS GEORGE WASHINGTON  
USS ABRAHAM LINCOLN  
USS JOHN F. KENNEDY  
USS HARRY S. TRUMAN

**NAS Fallon**

USS NIMITZ  
USS THEODORE ROOSEVELT  
USS ENTERPRISE  
USS KITTY HAWK  
USS CARL VINSON  
USS DWIGHT D. EISENHOWER

**Lemoor**

SFWSL, NAS Oceana, VA  
NSAWC, NAS Fallon, NV (3)  
Washington Navy Planning Center  
Imagery Analysis Directorate, WNY(2)

**1 - San Diego**

Alexandria, VA  
s, TX (3)

USS JOHN STENNIS  
USS CONSTELLATION

NSAWC, NAS Fallon, NV  
**Fighter Weapon School,**

**NSAWC, NAS Fallon**  
**USS THEODORE ROOSEVELT**  
**MAG-39 HSWINGSPAC, San Diego**  
**HC-6 Night Lab, Norfolk, VA**  
**USS BATAAN (2)**  
**COMSTRKFIGHTWINGPAC, NAS**

**Night Vision Lab, MCAS Iwakuni**  
**NAWCAD Det, NAS Oceana, VA**  
**NAWCAD, Pt. Mugu, CA**  
**Naval Spec Warfare Group**

**Anteon ISD, Alexandria, VA (3)**  
**LMMFC, Dallas, TX (2)**

## USMC (18)

MAG-11, MCAS Miran  
MAG-31, MCAS Beaufort, NC  
MAG-12, MCAS Iwakuni, Japan

MAG-36, MCAS Futema, Ja  
MAG-26, MCAS New River, NC

MAWTS-1, MCAS Yuma, AZ  
MAG-26, HMM-264, USS SAIPAN

MAG-29, HMM 263, USS WASP

MAG-13, 3MAW, MCAS Miramar

MAG-16, MCAS Miramar, CA  
HMM-365, MCAS New River, NC

MAG-36, MCAS Futen  
MAG-39, Camp Pendl CA

1MAW, MCBH Kaneoh HI

MAWTS-1, MCAS Yum

Night Vision Lab  
Jacksonville, FL

LMMFC, Dallas, TX

19th Barksdale AFB, LA  
19th Elmendorf AFB, AK  
(DBG Lakenheath, RABUK  
19th Mountain Home AFB, ID  
Seymour Johnson AFB, NC  
LMMFC, Dallas, TX  
19th SOS Hurlburt Field, FL



## USA (11)

160<sup>th</sup> SOAR, Ft. Campbell, KY (4800 IG)

160<sup>th</sup> SOAR, Ft. Campbell, KY (DBGF)

160<sup>th</sup> SOAR (A)

**160<sup>th</sup> SOAR (A) (3)**

NGIC IOD, WNY (DBGF) (2)

Camp Red Cloud, Korea

Camp Red Cloud, Korea

## TOPSCENE KEY

**Model 4000**

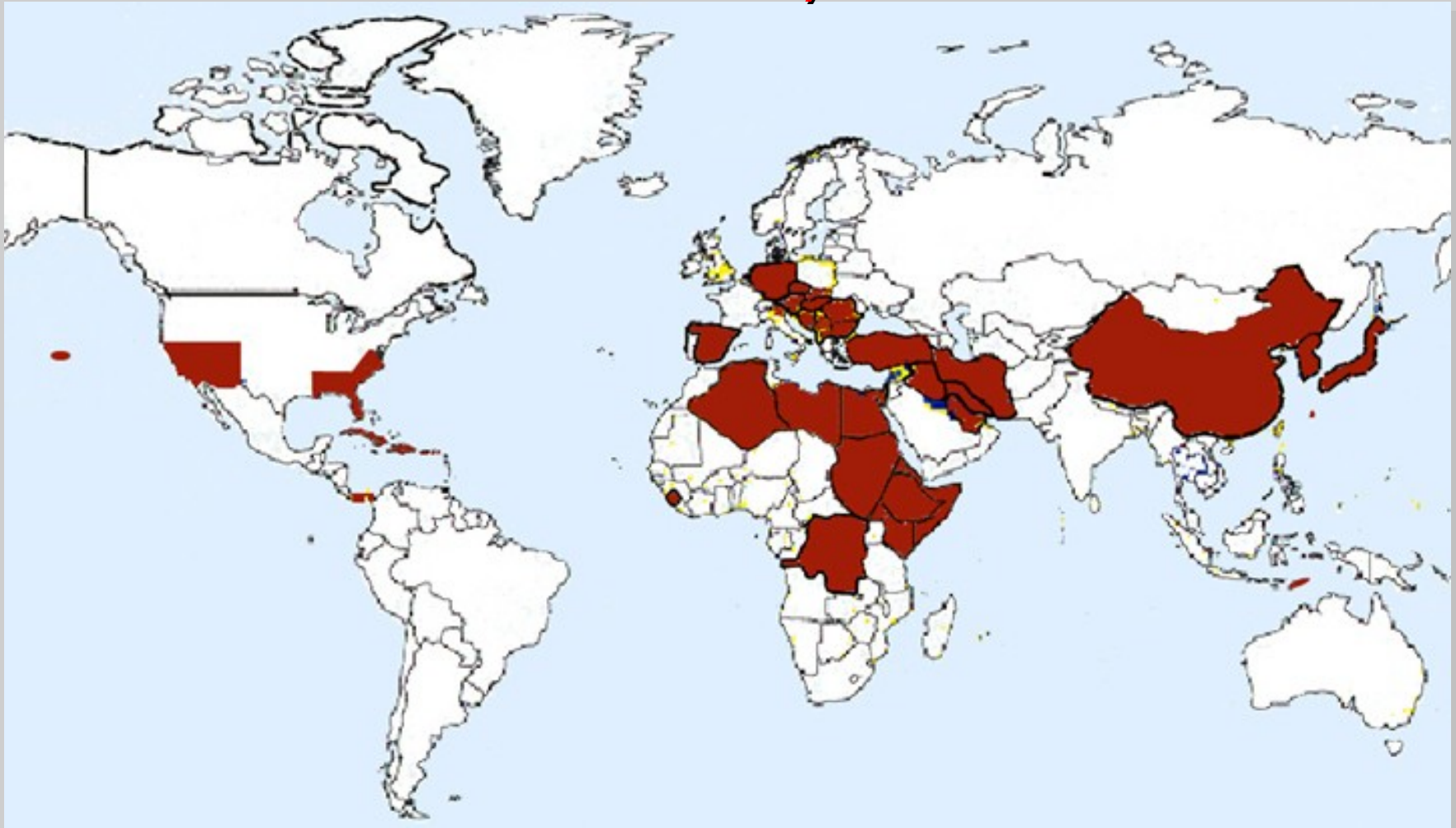
**Model 3500**

**Model 400**

**USAF PTT**



# Worldwide Database Holdings (cy-2000)



## **Some Lessons Learned**

### **Shipboard:**

- Hardware and software has pluses and minuses**
- Like any computer system it has its idiosyncrasies**
- Use varied by ship, squadron and personnel**
- Not surprisingly, used more at beginning of hostilities when terrain was less familiar to combatants and missions were strikes on planned targets**
- Early missions lended themselves to target familiarization, study and rehearsal.**

**Very Good success familiarizing key terrain**

**Studying target terrain for masking and comparing target orientations**

**Studying terrain relief for impact on weapon delivery**

## **Some Lessons Learned**

### **Shipboard:**

- **Still used when missions were on call but target area was somewhat defined**
  - Mission areas could still be studied for orientation**
- **Initially used less used when aircraft were launched but orbiting, waiting for target call that could be almost anywhere**
  - Potential target areas were considered too broad and numerous to effectively familiarize beforehand**
    - **However, provided comfort factor when transiting new areas**
- **Began increasing use as post-flight after-action report tool**
  - ID target specifics during debrief, and produce associated graphics**
- **Gaining after action feed-back difficult**

## **Some Lessons Learned**

### **CENTCOM HQ**

- Staff support**

**More product based than first person based**

**Jpegs and mpegs either alone or embedded in PowerPoint briefs**

- Have to stay on top of current operations**

**Staff briefing pace makes users feel they have no time for new things**

**Do not realize briefing support capabilities available to them**



## **Some Lessons Learned**

### **Training**

- **Shipboard system was unix based**  
Interface not same as PC and windows  
Working on more familiar Windows look menu interface on unix systems
- **New systems PC based with common menu look and feel**
- **Interfaces to existing applications, like PFPS/Falcon View**
- **Key will still be to use equipment during training periods, even if training scenario is familiar**

## **Some Lessons Learned**

**Logistics: Maintenance and database updates.**

**- Program Office sends personnel all over the world for in the field maintenance**

**If system is SIPRNET connected, Navy Facility at NAS Fallon can remote log onto system for diagnostics and repair remotely**

**- Database updates**

**Imagery files are not small (not a function of system)**

**Higher resolution, larger file**

**More coverage, larger file**

**For example: Afghan, Korea, Iraq, Iran and Bosnia databases**

**There is no magic solution to getting higher resolution or greater coverage in a smaller file**

**- Demands for currency**

**Honest appraisal of what areas truly need yesterday's**

## **Some Lessons Learned**

**Logistics: Maintenance and database updates.**

- **Database subsets for other computer applications**  
    **CD-ROM for PCs**  
    **External fire-wire drives for PCs, also range up to 180 gigabytes.**

- **Electronic transmission**  
    **Function of bandwidth**  
    **SIPRNET or JWICS connectivity**

- **Shipping classified**  
    **Classified hard-drive, CD-ROM or 8mm tape.**

**Domestic: US mail and some commercial carriers if between government controlled offices and retained in US controlled areas.**

**Allows overnight shipments**

**Overseas: US mail only**

## **Some Lessons Learned**

### **User demands for greater performance**

- Performance and capabilities depend on computing power and databases**
- Databases depend on source material and production organization**

**Systems must be source independent as much as possible**

**Ingest all resolutions and a maximum number of formats**

**Registration and rectification of data must be robust**

- Users want more data quickly, with smaller files but higher resolution**
- Users want to zoom out for more field of view, but want to see more detail**
- Users state that general familiarization capability and easy access with smaller computers is good enough**
- Users state they want more capabilities and greater detail which demands greater computing power**
- Some users only need target areas while others need ability to roam throughout mission area or through mission profile**

## **Current and Future capabilities**

- PC version is operational**

**As PC computing and graphics capabilities increased, the program has expanded into those platforms**

**And we will continue to do leverage commercial and specialized technology advances**

- PC versions for both Windows and Linux: Each has its advantages**

- PC, LINUX, UNIX versions are integrated or interfaced with Falcon View**

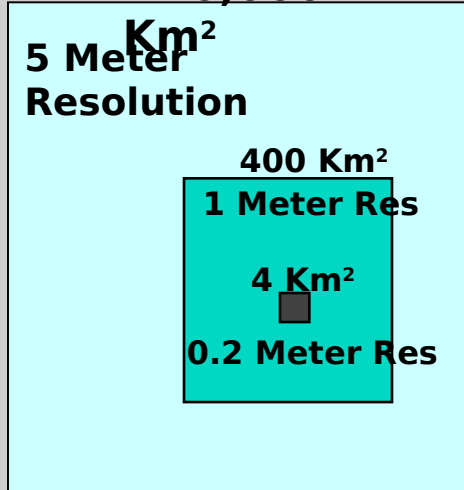
- Demonstrated real-time broadcast to palmtop as remote monitor using broadcast compression algorithms**  
**Need to research impact of encryption on those algorithms.**

- Demonstrated software to update databases forward with currently arriving imagery**  
**Configuration management, responsible agent.**

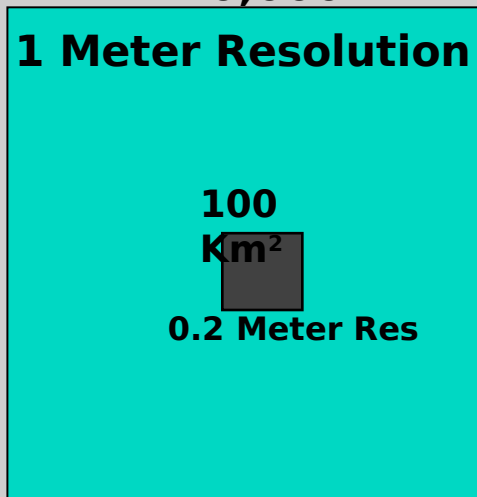


# Terrain Database Construction Examples and Timelines

\* 10,000



\* 10,000



**Example 1:** In 4 Hours, A Single Operator Can Produce 100Km x 100Km Database with 4 Medium Resolution and 1 High Resolution Inset and 25 Buildings.

No. Of Images	Resolution	Area
1	100 Km X 100 Km	0.5
4	1 m	20 Km X 20 Km 1 Hr
1	0.2 m	2 Km X 2 Km 0.5 Hr
<b>Features</b>		2 Hours
No. Of Buildings	Rate	Approx. 2 Hours
25	12.5 Hr	2 Hours
<b>Total Time</b>		4 Hours

**Example 2:** In 28 Hours, 2 Operators Can Produce: 100km x 100km Database with 50 Medium Resolution and 4 High Resolution Inset and 50 Buildings.

No. Of Images	Resolution	Area
50	100 Km X 100 Km	20
4	0.2 m	10 Km X 10 Km 4 Hr
<b>Features</b>		24
No. Of Buildings	Rate	Approx. Time
50	12.5 Bldgs / Hr	4 Hours

\* Sample database update size. Total database size is unlimited. **Total Time 28 Hours**

# Database Production Rationale

5 Meter resolution Out-the-Window view from 20k'



<1 Meter resolution Target

Acquisition & Decision Sensor View



**Complete situational awareness requires  
high resolution, high fidelity imagery  
even at high altitudes**

# Database Production Rationale



**5 Meter resolution  
Out-the-Window  
scene  
from 500'**

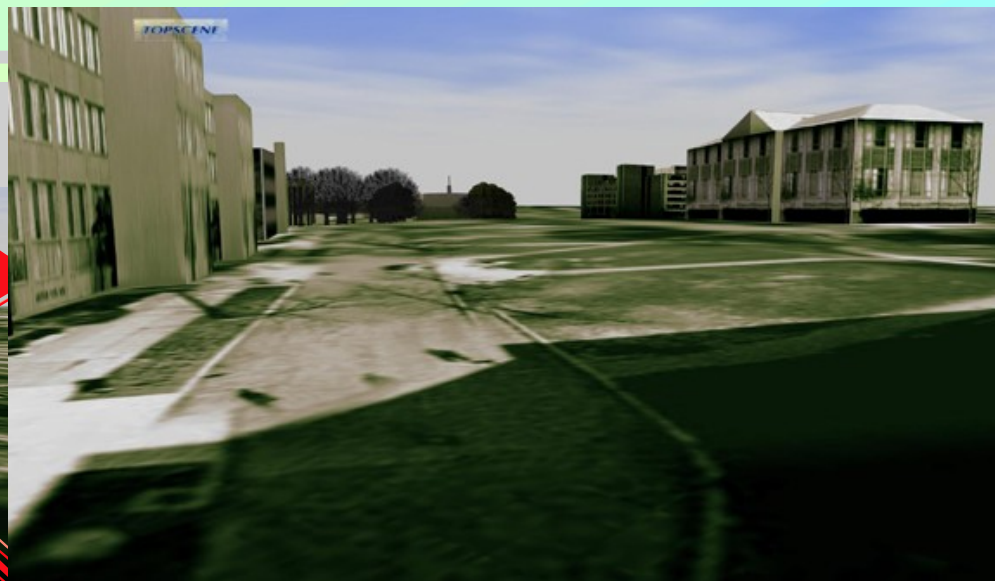
**<1 Meter resolution  
Out-the-Window  
scene  
from 500'**



**Low altitude ingress / egress and helicopter  
operations require at least 1M resolution**

# Database Production Rationale

**<1 Meter  
Out-the-Window  
Target View <500'**

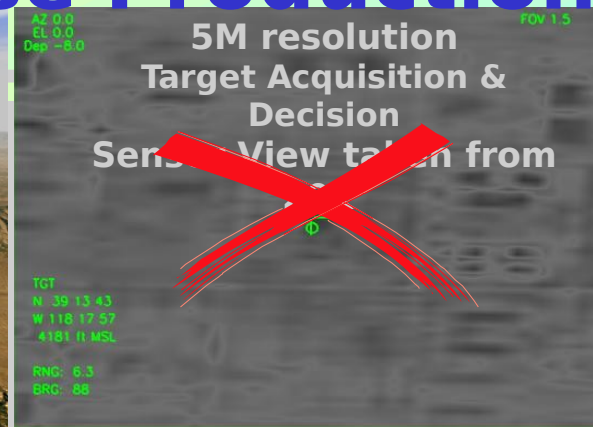


**<1 Foot  
Out-the-Window  
Target View  
<500'**

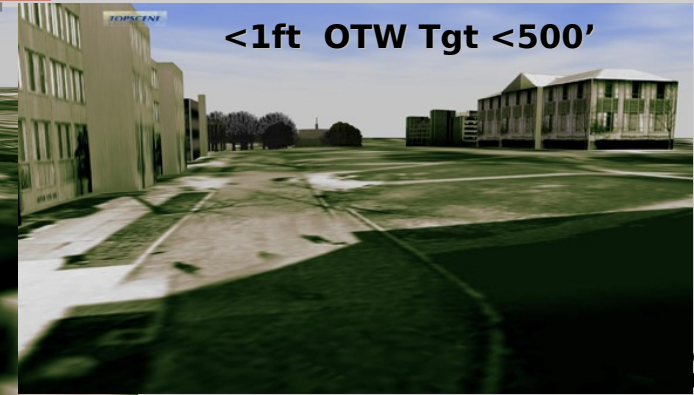
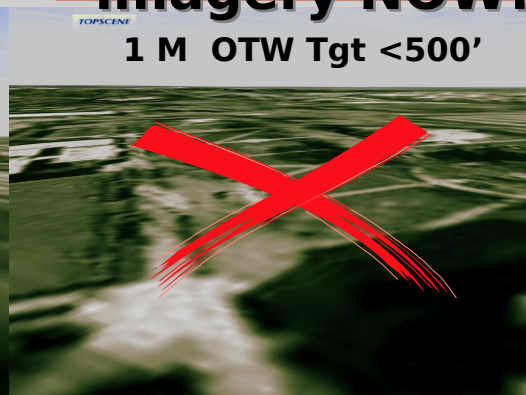
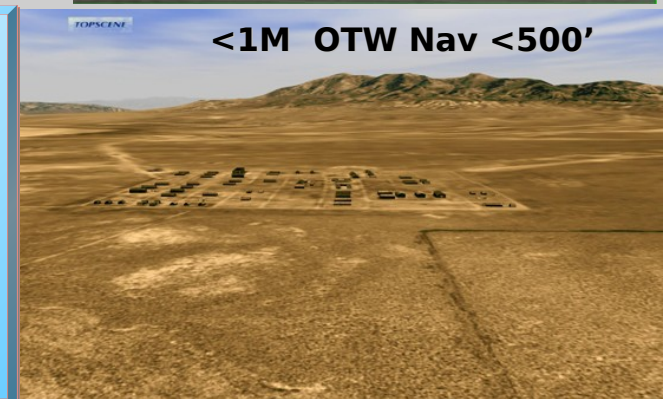
**Special Operations, Ground Maneuver Forces,  
Target Study requires < 1M resolution**



# Database Production Rationale



**TOPSCENE  
DBGFs produce  
databases at  
<1 M and <1  
FT from all  
source  
imagery NOW!**





# All Weather Tactical Simulation Is Provided From High Resolution



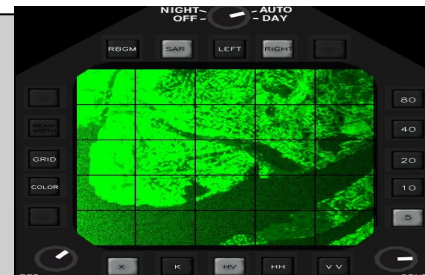
**Night Vision Display  
(NVD)**

- Ambient Light - Noise
- Light Sources - Effects
- IR Spot Light (NVG Illuminator)



**InfraRed  
(IR)**

- Physics Based Radiance
- Time of Day / Time of Year
- Variable Sensor Parameters
- Diurnal Weather



**Real-Beam Radar /  
SAR**

- Radar Signature Coded Texture
- Terrain Elevation Shadows and Masking
- 3D Culture Shadows

**Correlated  
Material Coded per Pixel  
Physics-Based**



**EO Scene**

- Country Size Coverage (100 Geo-Cells)
- 100 GB of Texture

**Photographic Databases  
Developed From Satellite  
Imagery Are Common to All  
Systems**



**All COTS H/W 4000 \$/W**

**Distribution**

**DIS & COMPASS Compliant**

**Y2K Compliant**

**SCI Security Accredited**

**Human Engineered**

**Operator**

**Controls/Keyboard/Mouse**

**Shock Mounted**

**Transportable (3 Sections)**

**Special Effects**

**Fog / Visibility / Clouds / Time of Day**

**Dual Monitor Color / Monochrome**

**Moving Models (F18, Tanks, Etc.)**

**Window-in-window**

**Large Area Data Storage (~1**

**TByte compressed, ~5 TBytes uncompressed)**

**Composite Capabilities (F18**

**Typical)**



# ***Model 4800 Mission Rehearsal Image Generator (IG)***

## ***State of the Art Mission Rehearsal IG***

- Realistic Terrain Databases with Full Fidelity Mission Functions
- Rapidly Produced / 3D Feature Content / MR Training
- F-18 Training of:
  - OTW / SLAM Prototype
  - OFT Integration - Oceana

## ***JSF Cockpit Demonstrators (11/99)***

- Warfighter Enterprise Center - LMAC
- Washington D.C. - LM Corp

## ***USASOC - 160th***

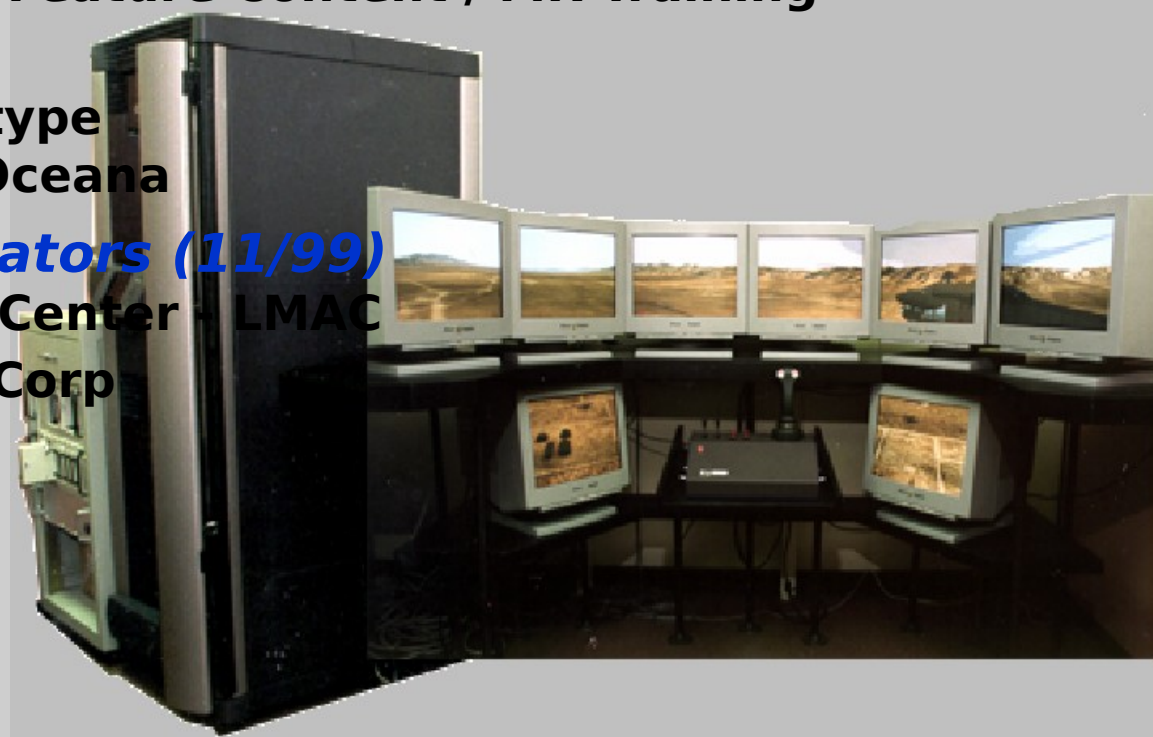
### ***SOAR(A)***

***at Fort Campbell, KY  
(8/99)***

- MH-60K Blackhawk
- MH-47E Chinook

## ***AFSOC 19th SOS at Hurlburt Field, FL (8/00)***

## ***Common Low-Cost Databases***



# TOPSCENE Model 400

**SGI  
Octane**

**High Resolution  
Monitor**

- **Systems Elements (All COTS)**
- **PC Size Footprint**
- **Imagery Products and Processes Produce Real World Scenes**
- **MODSAF DIS Compatible**

**Removable  
Digital  
Storage**

**Operator  
Controls**



## ***A Portable Scalable COTS Solution for Geo-Specific Mission Rehearsal***

### **SYSTEM ELEMENTS**

- PC OR Laptop Computer
  - Open GL Graphics Card
  - NT 4.0 or Windows 2000
  - AGP or PCI Bus
- Open Architecture Provides Scalable Performance
- Operator controls (mouse, keyboard, joystick)
- High-Resolution Color Monitor (1280x1024)
- Digital Media Supported (Disk, CD, DVD, . . .)

### **INTEROPERABLE WITH PORTABLE FLIGHT PLANNING SYSTEMS (PFPS)**

- Integrated and Co-hosted on Same Platform
- Automatic Route Pull into TOPSCENE
- Nav Point Selection/Sequencing
- Route Server Integrated
- FalconView Map Server



### **IMAGERY PRODUCTS AND PROCESSES PRODUCE REAL-WORLD SCENES**

- Fly-through, walk-through of integrated imagery with 3-D cultural features
- 3-D geo-specific cultural content (buildings, towers, etc.)
- Full Color and Black/White databases supports aviation and ground applications
- Multi-Resolution Imagery supported (.25m, 1m, 5m, . . .)



# **TOPSCENE Model 40**

## **PC -Based Mission Preview**

## ***TOPSCENE Model 40***



*Deployable Mission Rehearsal  
- Scalable Performance*

## ***TOPSCENE Model 40***

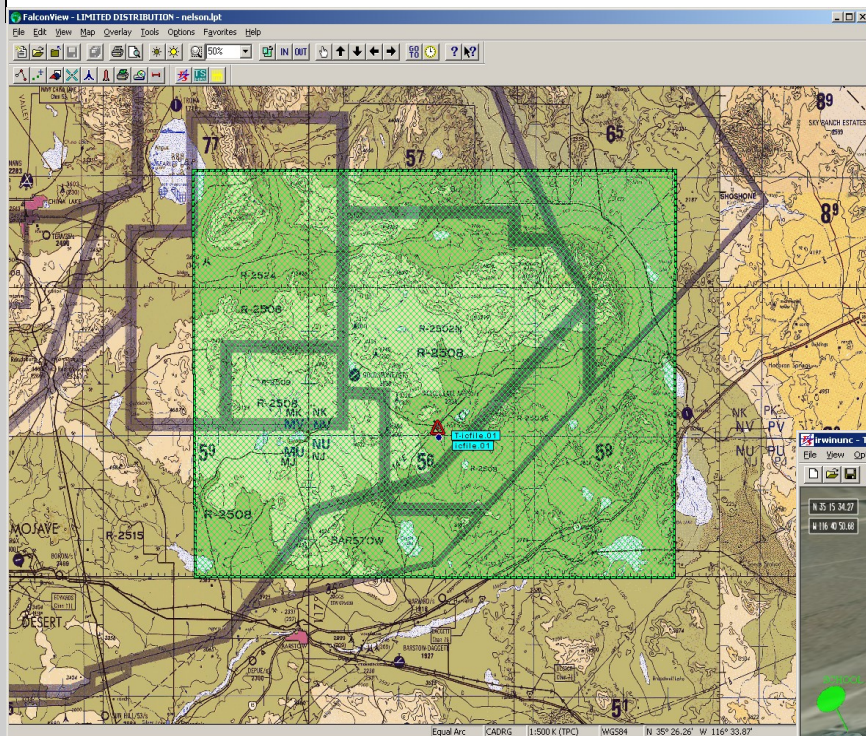
*Open Architecture Provides Scalable Performance*

- *PC or Laptop Compatible*
  - *Open GL Graphics Card*
  - *Windows XP, NT 4.0 or 2000*
- *Operator Controls*
  - *Mouse (3 Button and Scroll)*
  - *Universal Joystick (User Configurable)*
  - *Keyboard / Keypad*
  - *Pull Down Menus and Hotkeys*



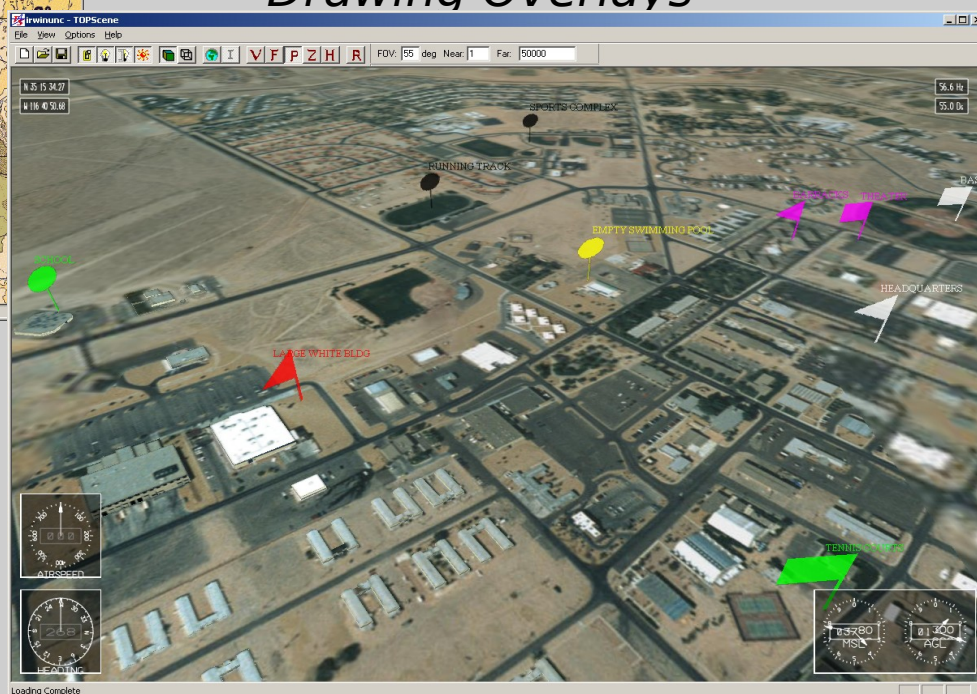


# TOPSCENE Integration with PFPS



## Common Software Interface Approach

- Extensive Use of PFPS “Server” APIs
  - Route Server
  - Map Server
  - Drawing Overlays



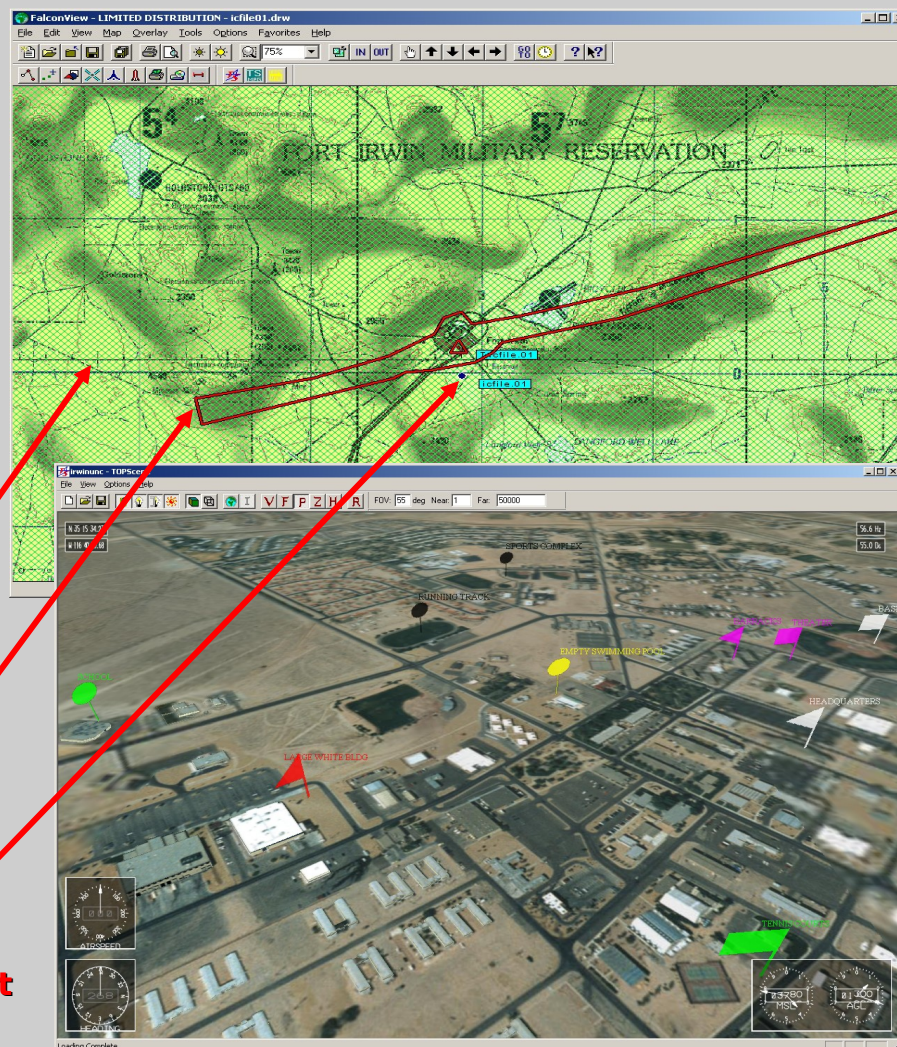


# TOPSCENE Integration with PFPS

## Common Software Interface Approach

- **PFPS Route Server**
  - Pull Route from PFPS
  - Visualize in 3D on TOPSCENE
- **Fly Route on TOPSCENE**
  - “Bread Crumb” Track on PFPS via GPS Tool
- **Common Symbology PFPS/TOPSCENE**
  - Initial Position
  - Way Points
  - Objective

Coverage  
Shapefile  
ROI - DRW  
Icfile -  
local point





# Visual Features

## TOPSCENE Common Database and Models

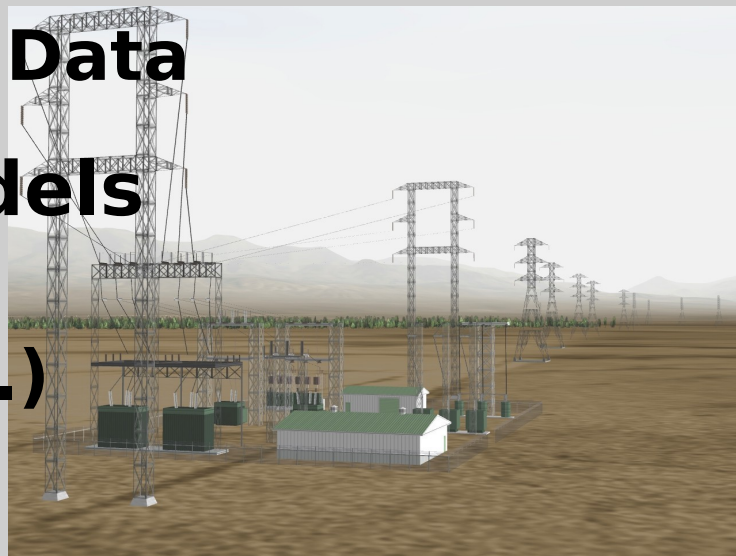
- **Native TOPSCENE Format**
  - Full Country-Size Database
  - Smaller Regional Area Subsets
- **Full Color and Colorized Data**
- **Large Area Features**
  - Dense Tree / Forest Areas
- **Compatibility with Open Standard 3D Models**
  - Export TOPSCENE Data into OpenFLT (Buildings, Unique Terrain Features, etc.)



# Visual Features

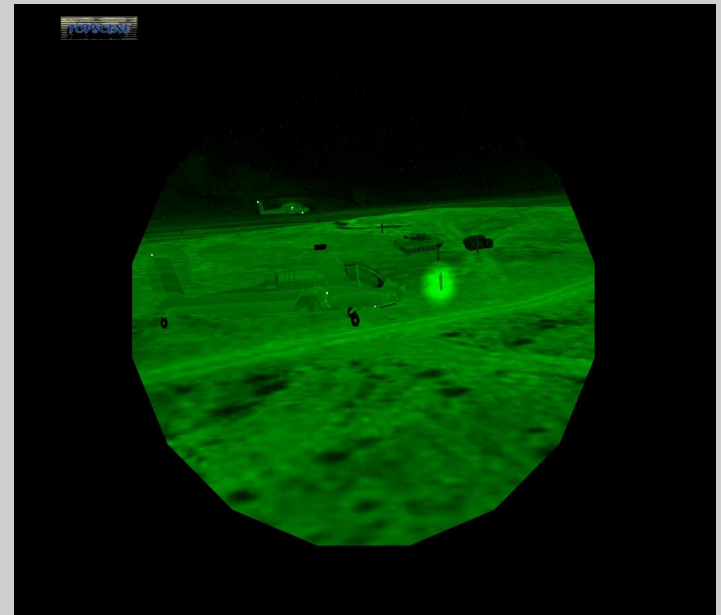
## *Industry Standard Common Formats*

- **Controlled Image Base (CIB) and DTED**
  - **Direct Ingest and Play**
  - **No Special Formatting Required**
  - **Compatible with PFPS Data**
- **Open Standard 3D Models**
  - **OpenFLT Library (Aircraft, Vehicles etc.)**
  - **Vertical Obstruction Data Library (Towers, Pylons etc.)**



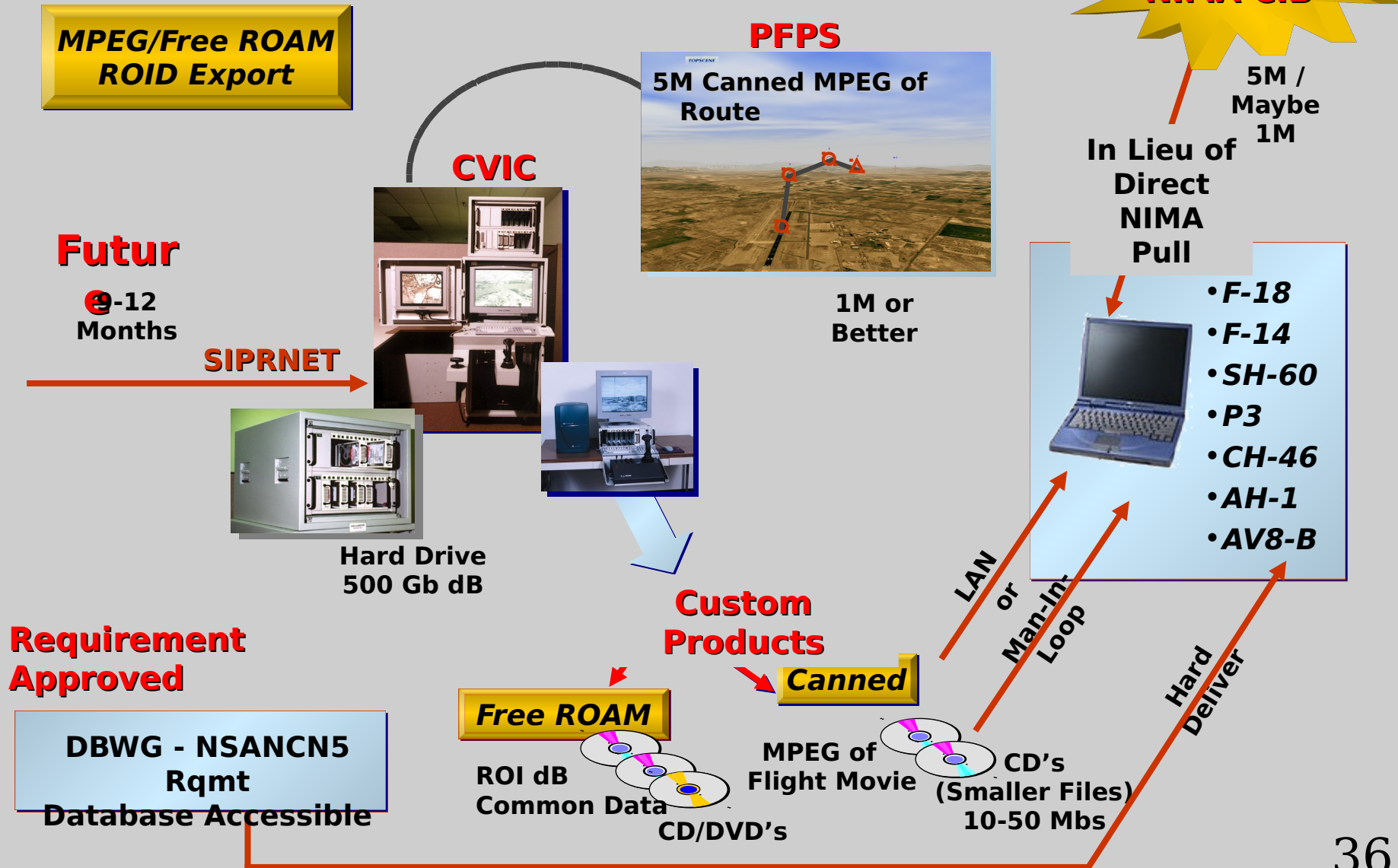
# TOPSCENE Visual Features

- *New Features – Available April 2003*
  - *Night Vision Goggle Simulation*
  - *Physics-based FLIR Simulation*
- *Database Tools*
  - *PC-Based Manipulation*
  - *Scene Content Selection*
  - *New Data Construction –*  
*(Buildings, Trees,*  
*Models etc.)*



# Current Developments

# Route/Gamming Area



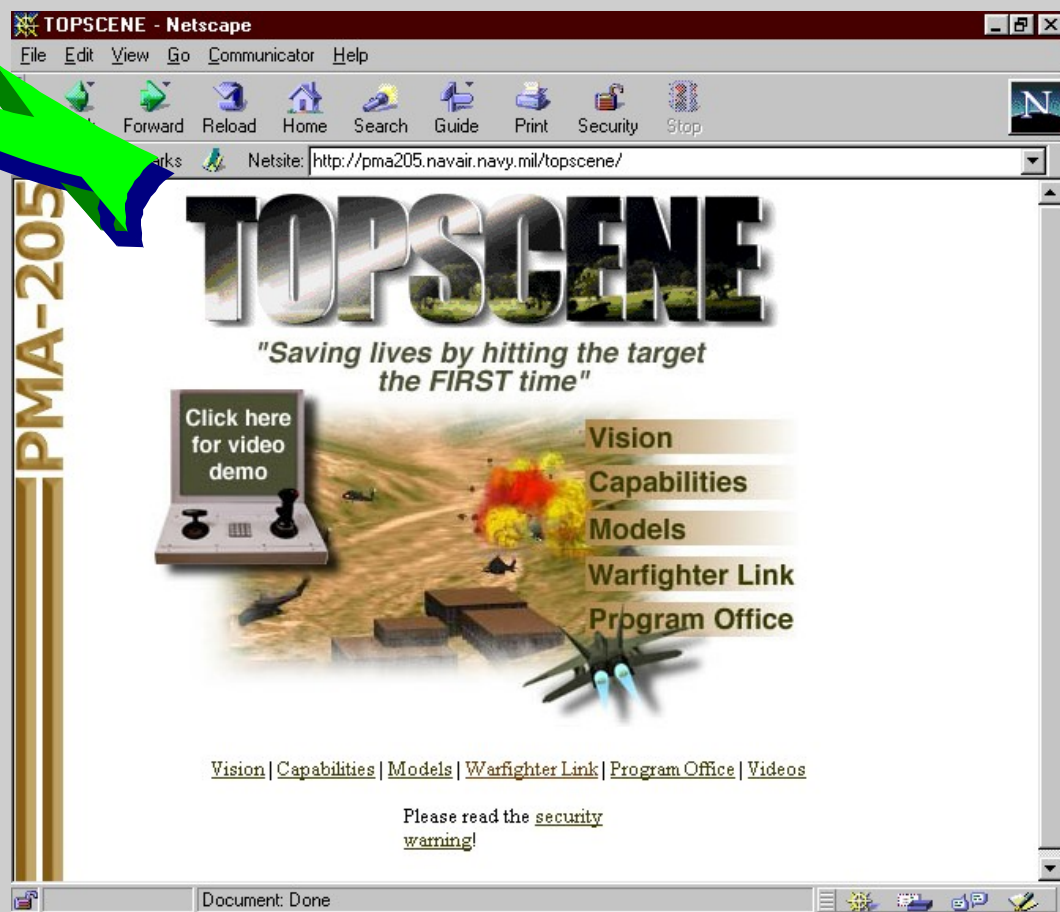
# ***2003 Interoperability Developments***

- *DATABASE DISTRIBUTION SERVER*
- *PFPS / FALCONVIEW*
- *OTH - GOLD*
- *JMPS*
- *C2PC*
- *DIS / DI-GUY*
- *CRD*
- *DATA*
  - *OPENFLIGHT*
  - *CIB*
  - *GEOTIFF*
  - *NITF*

# Visit the TOPSCENE Website

<http://pma205.navair.navy.mil/topscene>

- Integrated Digital Environment
- Video's & Demo's
- Warfighter Link
  - On-Line Status
  - System Inventory
  - Trouble Reports





# Naval Mission Rehearsal Program (TOPSCENE)

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**Web Site: <http://pma205.navair.navy.mil/topscene>**

**NAVAIR PMA205**

